

EPA Coalbed Methane Outreach Program Technical Options Series

USE OF COAL MINE METHANE IN GREENHOUSES



Greenhouse facility near Harrisburg, Illinois grows hydroponic tomatoes and cucumbers (Coal mine methane-fueled cogeneration system produces on-site electricity and thermal heat)

PROFITABLE OPPORTUNITIES FOR GREENHOUSE AND MINE OPERATORS

GREENHOUSES CAN...

- ◆ Use methane from coal mine pre-drainage and gob wells as a heating fuel
- ◆ Use electricity generated on-site or nearby from coal mine methane
- ◆ Use CO₂-enriched coal mine ventilation air to maintain consistent temperatures and stimulate plant growth
- ◆ Use coal mine wastewater for irrigation at some locations

Why Consider Using Coal Mine Methane in Greenhouses?

Depending on negotiations, coal mine methane can be cheaper than conventional natural gas for heating

Many coal mines in the United States and other countries emit high volumes of methane. In the U.S., these volumes may range from less than 0.5 million cubic feet per day (mmcf/d) to more than 10 mmcf/d. Greenhouses can use coal mine methane to meet their energy requirements. Several gassy mines in the United States are capable of meeting the heating and electricity requirements that most greenhouses have. A mine can usually sell methane at a negotiated price that is lower than what the greenhouse would pay for conventional natural gas or other fuels. As a result, greenhouses can reduce their operating costs, while the mine benefits from sale of the methane.

In southern Illinois, Grayson Hill Farms, Inc. operates a greenhouse that uses methane from a nearby abandoned coal mine to produce electricity and thermal heat for growing tomatoes and cucumbers. Three Ford and International truck engines produce 75-80 kW of electricity each, enough power to meet all the electricity needs of the greenhouse. Excess electricity up to 50 kW is sold back to a utility company via the local grid. In addition, the cogeneration power system uses exhaust heat from the engines to produce hot water for the greenhouse's heat-radiant floors. Methane from the mine is also used to fuel gas heaters and CO₂ generators inside the greenhouse.

The cost of producing electricity on site using coal mine methane could be as low as \$0.03 per kWh, which is typically less than commercial power rates

While the primary driving forces for locating greenhouse operations near gassy coal mines are the potential net energy savings for the use of methane for heating and/or electricity production, there may be secondary financial benefits as well. One secondary benefit is the potential for use of mine ventilation air in a greenhouse to help stimulate plant growth. Ventilation air is rich in CO₂ (2,000-3,000 ppm in ventilation air as compared to 300-400 ppm in the atmosphere). Ventilation air also remains at a fairly constant temperature year-round, which can help maintain consistent greenhouse temperatures. Another potential benefit is the use of mine wastewater for irrigation purposes in cases where the quality of this water is suitable for greenhouse needs.

Benefits for Greenhouses, Coal Mine Operators, and the Environment ...

- **New Markets.** Coal mines need a market for their methane, and greenhouses have a large energy demand.
- **Lower Prices.** In many cases, gassy coal mines can supply methane to a greenhouse at a lower cost than commercial retail gas or electricity prices.
- **Increased Revenue.** Coal mine operators gain additional, stable revenue sources.
- **Reduced Costs.** The greenhouse operator would benefit from reduced energy costs, water, and CO₂.
- **Environmental.** Use of coal mine methane protects the global environment by reducing emissions of methane, a greenhouse gas, to the atmosphere.

Some greenhouses have been able to reduce heating costs by 87% using mine ventilation air to modify greenhouse temperatures

Key Factors Affecting Coal Mine/Greenhouse Project Economics...

- For a project to be economic, the mine must generally be able to recover at least 0.3 mmcf/d of methane
- Greenhouses with electricity needs of at least 5 million kWh/year and heating needs of at least 100 billion BTUs/year will be good candidates
- Projects with smaller greenhouses can be profitable given certain site-specific and market conditions (e.g., high electricity rates, cold climate, and high water costs)
- Locating the greenhouses close to the mine can minimize fuel transport costs

Additional information on this topic can be found in the EPA report, *Making Coal Mine Methane Work for You: A Guide to Coal Mine/Greenhouse Projects*, November 1998.

For More Information...

Greenhouse operators are seeking ways to improve economics by reducing fuel costs. Meanwhile, increasing numbers of coal mine operators are initiating methane recovery projects in an effort to increase mine safety and productivity, as well as gain additional revenues from methane sales. The use of coal mine methane in greenhouses can provide financial benefits to both parties.

EPA is analyzing the economic and financial benefits of coal mine methane use in greenhouses. For more information about this and other profitable uses for coal mine methane, contact:

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